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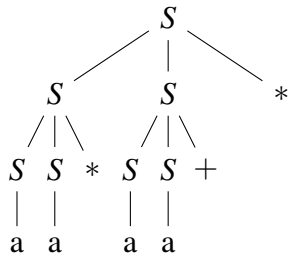
ASSIGNMENT 3

1 Required Exercises

1.1 Exercise 1

1. No, it isn't.
2. $S \underset{lm}{\Rightarrow} SS* \underset{lm}{\Rightarrow} SS*S* \underset{lm}{\Rightarrow} \mathrm{a}S*S* \underset{lm}{\Rightarrow} \mathrm{aa}*S* \underset{lm}{\Rightarrow} \mathrm{aa}*SS+* \underset{lm}{\Rightarrow} \mathrm{aa}*\mathrm{a}S+* \underset{lm}{\Rightarrow} \mathrm{aa}*\mathrm{aa}+*.$
3. $S \underset{rm}{\Rightarrow} SS* \underset{rm}{\Rightarrow} SSS+* \underset{rm}{\Rightarrow} SS\mathrm{a}+* \underset{rm}{\Rightarrow} S\mathrm{aa}+* \underset{rm}{\Rightarrow} SS*\mathrm{aa}+* \underset{rm}{\Rightarrow} S\mathrm{a}*\mathrm{aa}+* \underset{rm}{\Rightarrow} \mathrm{aa}*\mathrm{aa}+*.$
4. The parse tree is depicted as follows.



5. The grammar can be rewritten as follows.

$$S \to \mathrm{a}S',$$
$$S' \to S+S' \mid S*S' \mid \varepsilon.$$

1.2 Exercise 2

1. (a) Calculate the FIRST and FOLLOW sets for the grammar.

$$\begin{aligned}\mathrm{FIRST}(S) &= \{\mathrm{a}\},\\ \mathrm{FIRST}(B) &= \mathrm{FIRST}(S)\cup\{\varepsilon\} = \{\mathrm{a},\varepsilon\},\\ \mathrm{FOLLOW}(S) &= \{+,\$\},\\ \mathrm{FOLLOW}(B) &= \mathrm{FOLLOW}(S)\cup\{\$\} = \{+,\$\}.\end{aligned}$$

(b) Construct the predictive parsing table for the grammar.

NON-TERMINAL	INPUT SYMBOL		
	a	+	$
S	$S \to \mathrm{a}B$		
B	$B \to S+B$	$B \to \varepsilon$	$B \to \varepsilon$

2. Yes, it is.

3. Yes, it can. The moves are listed as follows.

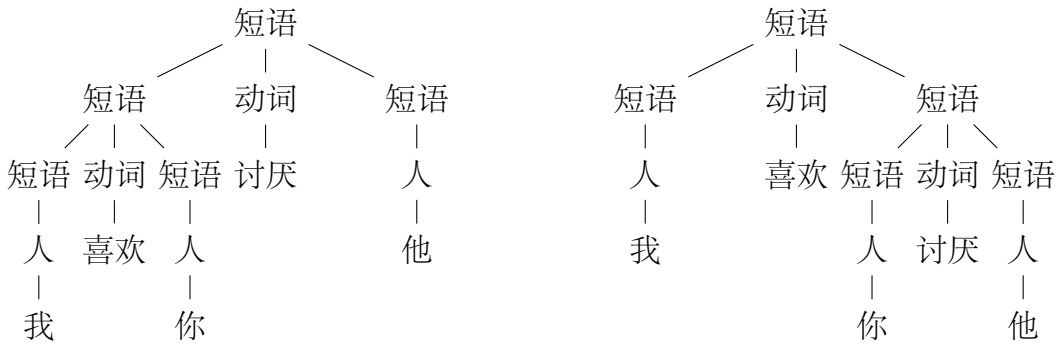
MATCHED	STACK	INPUT	ACTION
	$S\$$	aaaa$+++\$$	
	a$B\$$	aaaa$+++\$$	output $S \to aB$
a	$B\$$	aaa$+++\$$	match a
a	$S+B\$$	aaa$+++\$$	output $B \to S+B$
a	a$B+B\$$	aaa$+++\$$	output $S \to aB$
aa	$B+B\$$	aa$+++\$$	match a
aa	$S+B+B\$$	aa$+++\$$	output $B \to S+B$
aa	a$B+B+B\$$	aa$+++\$$	output $S \to aB$
aaa	$B+B+B\$$	a$+++\$$	match a
aaa	$S+B+B+B\$$	a$+++\$$	output $B \to S+B$
aaa	a$B+B+B+B\$$	a$+++\$$	output $S \to aB$
aaaa	$B+B+B+B\$$	$+++\$$	match a
aaaa	$+B+B+B\$$	$+++\$$	output $B \to \varepsilon$
aaaa+	$B+B+B\$$	$++\$$	match +
aaaa+	$+B+B\$$	$++\$$	output $B \to \varepsilon$
aaaa++	$B+B\$$	$+\$$	match +
aaaa++	$+B\$$	$+\$$	output $B \to \varepsilon$
aaaa+++	$B\$$	$\$$	match +
aaaa+++	$\$$	$\$$	output $B \to \varepsilon$

2 Optional Exercises

2.1 Exercise 1

Yes, it is ambiguous.

e.g. 我喜欢你讨厌他



(a) Parse tree 1

(b) Parse tree 2

Figure 1: Two parse trees for the ambiguous sentence